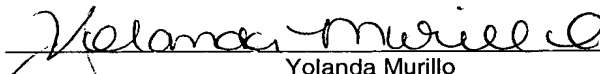




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**CERTIFICATE OF MAILING 37 CFR 1.8**

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Yolanda Murillo

**PATENT**

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re Application of:  
WILLIAM S. BRENNAN

Serial No.: 09/883,883

Filed: 6/18/2001

For: CLOSED LOOP RESIDUAL GAS  
ANALYZER PROCESS CONTROL  
TECHNIQUE

Group Art Unit: 2823

Examiner: WILLIAM D. COLEMAN

Atty. Dkt. No.: 2000.046500/JAP

**APPEAL BRIEF**

**Mail Stop Appeal Brief – Patents**

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

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## **I. REAL PARTY IN INTEREST**

The real party in interest is Advanced Micro Devices ("AMD") Inc.

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Claims 1-36 are pending in the case. Claims 16-36 were withdrawn from consideration, leaving only claims 1-15 for examination. The Office Action:

- rejected claims 1, 2, 5-15 as anticipated under 35 U.S.C. § 102 (a) by U.S. Application Serial No. 09/752,805 ("Egermeier, *et al.*"), also identified as U.S. Patent Publication No. 2002/0006677; and

- rejected claims 3-4 as obvious under 35 U.S.C. § 103 (a) by Egermeier, *et al.* in combination with U.S. Letters Patent 5,865,900 ("Lee, *et al.*").

Applicant traverses each of the rejections.

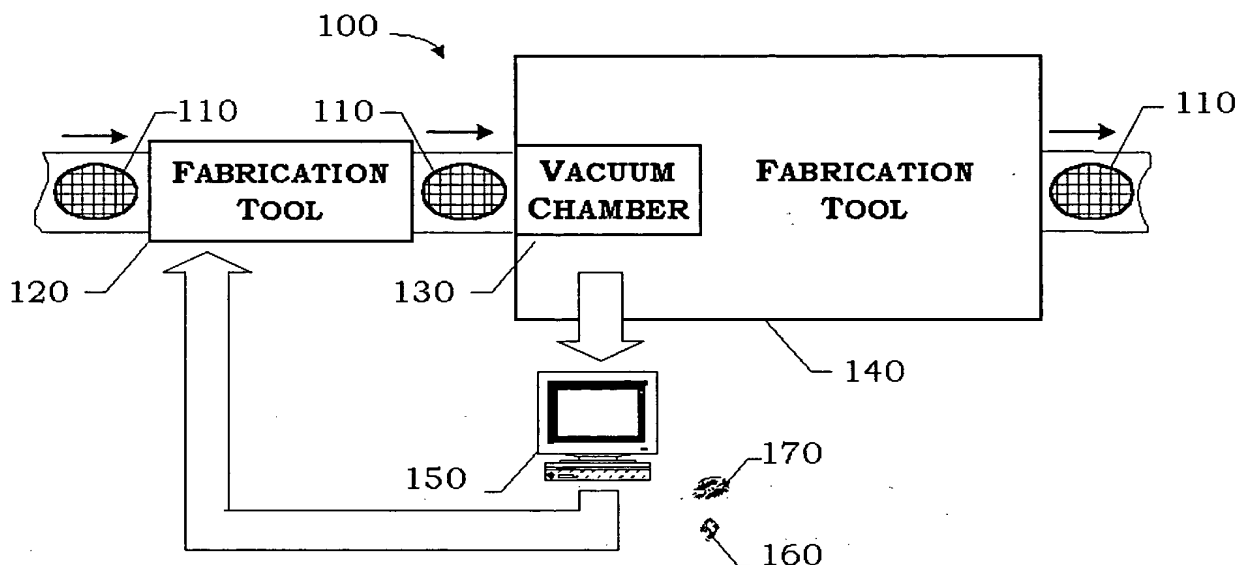
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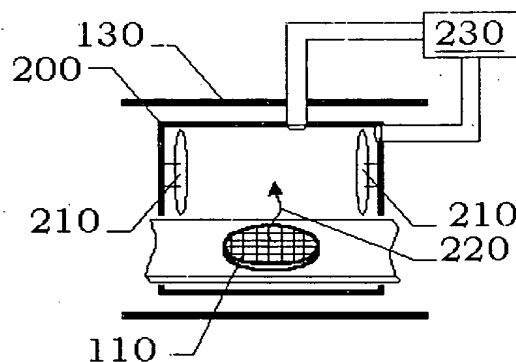
The invention, in its various aspects and embodiments, is a method and apparatus for use in fabricating an integrated circuit. The method generally begins by performing (310, in Figure 3) an operation on a wafer using a fabrication tool. Figure 1, reproduced below, illustrates an exemplary process flow 100, typically comprising a portion of a much larger process flow, a first fabrication tool 120 operates on one or more wafers 110 or batches or lots of wafers 110. The nature of the operation will depend on the type of the fabrication tool 120. For instance, the fabrication tool 120 might perform a chemical-mechanical polishing operation that might leave slurry or chemicals on the wafer 110, or conduct some type of

patterning, such as etching, that might leave residual photoresist or polymers on the wafer 110.



**FIG. 1**

The wafer 110 is then forwarded to a second fabrication tool 140 that includes a vacuum chamber 130 into which the wafer 110 is loaded. Turning now to Figure 2, reproduced below, the vacuum chamber 130 has been modified by the addition of a residual gas analyzer ("RGA") 230. The RGA 230 performs a spectroscopic analysis of vapors desorbed from the wafer 110 to obtain data indicating whether there is any residual



**FIG. 2**

slurry or photoresist (not shown) on the wafer 110 from the operation of the fabrication tool 120. More particularly, the wafer 110 is loaded into a heated vacuum chamber 200 attached to the RGA 230. Gaseous volatiles, *e.g.*, water or hydrocarbons, are emitted during the desorption, as symbolized by the arrow 220. A sensor head of the RGA 230 detects these volatiles and outputs raw spectral data indicating the content and quantity of the volatiles.

Thus, volatiles are desorbed (at 320, Figure 3), as indicated by the arrow 220, from the wafer 110. The desorbed volatiles are sampled (at 330, Figure 3) and raw spectral data indicating the content of the desorbed volatiles is generated (at 340, Figure 3). The raw spectral data is subjected (at 350, Figure 3) to a spectroscopic analysis. An operational parameter of the fabrication tool is then modified (at 360, Figure 3) responsive to the results of the spectroscopic analysis.

In one particular aspect of the invention, a controller receives the raw spectral data and processes the raw spectral data to determine the presence of a residual material on the wafer. The controller then controls the process flow operation to reduce the amount of the residual material on the wafer responsive to the results of processing the raw spectral data. Other aspects of the invention include the apparatus implementing the process flow and the controller itself.

## **VI. ISSUES ON APPEAL**

A. Whether claims 1, 2, 5-15 are anticipated under 35 U.S.C. § 102 (a) by U.S. Application Serial No. 09/752,805 (“Egermeier, et al.”), also identified as U.S. Patent Publication No. 2002/0006677.

B. Whether claims 3-4 were obvious at the time they were made under 35 U.S.C. § 103 (a) by Egermeier, *et al.* in combination with U.S. Letters Patent 5,865,900 (“Lee, et al.”).

## **VII. GROUPING OF THE CLAIMS**

Claims 1-9 rise and fall together and claims 10-15 rise and fall together, but claims 1-9 rise and fall separately from claims 10-15. Applicant groups the claims in this fashion because independent claims do not recite the same limitations and because Applicant argues patentability herein on the basis of different limitations in independent claims 1 and 10.

## **VIII. ARGUMENT**

Applicant respectfully submits that the art of record fails to disclose all the elements of claims 1-15. More particularly, the art of record fails to disclose:

“modifying an operational parameter of the fabrication tool responsive to the result of the results of the spectroscopic analysis,” as recited in independent claim 1 and, hence, dependent claims 2-9; and

“controlling a process flow operation to reduce the amount of the residual material on the wafer responsive to the results of processing the raw spectral data,” as recited in independent claims 10 and, hence, dependent claims 11-15.

Applicant also respectfully submits that the rejections of claims 10-15 are *prima facie* deficient.

**A. Claims 1-9 are Patentable over Egermeier, *et al.* Alone or in Combination With Lee, *et al.***

The rejections of claims 1-9 all rely on Egermeier, *et al.*,<sup>1</sup> for teaching “modifying an operational parameter of the fabrication tool responsive to the result of the results of the spectroscopic analysis”, recited in claim 1, at lines 8-9. The Office Action cites paragraph 25 of Egermeier, *et al.* as teaching this limitation, which paragraph reads:

[0025] At step 110, a decision is made as to whether the wafer (via the effluent data point) is within the baseline. The requisite comparison is in real-time and generates a signal in the event the analysis indicates contamination of the wafer. In such event, the wafer is rejected from subsequent processing in step 112 (i.e., is withdrawn for reprocessing, such as by being returned to the prior processing operation carried out to remove residual layers). In the absence of a signal indicating contamination, the wafer is forwarded, typically by robotic transfer means, to the next operation in the processing sequence in step 114. The method of the present invention ends at step 116.

This paragraph clearly states that the consequence of the decision making process is the removal from or forwarding to the process system of a contaminated wafer. There is no mention “modifying an operational parameter.”

In response to this argument, the Office replied:

See paragraph [0025] where Egermeier teaches at step 110, a decision is made as to whether the wafer is within the

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<sup>1</sup> Egermeier, *et al.* is not prior art to Applicant’s invention. Egermeier, *et al.* is applicable only under the Office’s legal fiction that any application filed before the case under examination is prior art under 35 U.S.C. § 102 (e). Applicant may dispel this legal fiction by “swearing behind” Egermeier, *et al.*, but is not required to do so. Applicant chooses at this time to distinguish Egermeier, *et al.*, reserves the right for exercise at a later date, and disputes the Office’s categorization of Egermeier, *et al.* as prior art.

baseline. The wafer is rejected from subsequent processing and is withdrawn for [sic] processing. This term is equivalent to Applicants "modifying an operational parameter of the fabrication tool responsive to the result of the spectroscopic analysis. Therefore Applicants arguments are moot."

This response is faulty in a number of respects, such as the fact that the Office's disagreement with Applicant's construction does not moot Applicant's argument, but merely contests it. However, more seriously, there is no reasoning as to why rejecting a wafer is equivalent to modifying an operational parameter. Applicant respects that the statement is without merit since modifying an operation parameter will affect subsequent processing of other wafers whereas rejecting a wafer will no absolutely no affect on subsequent processing of other wafers.

**B. Claims 10-15 are Patentable Over Egermeier, *et al.***

The rejections of claims 10-15 all rely on Egermeier, *et al.* for teaching "controlling a process flow operation to reduce the amount of the residual material on the wafer responsive to the results of processing the raw spectral data." Applicant notes that the "final" Office Action failed to point out where Egermeier, *et al.* allegedly teaches this limitation. Thus, the Office has failed to discharge its *prima facie* burden of demonstrating anticipation of claims 10-15. However, even were this not so, Applicant respectfully submits that Egermeier, *et al.* teaches no such "controlling," but is instead directed to rejecting defective wafers, as is established above.

Applicant also notes that the "final" Office Action states that "...Applicants [sic] do not traverse the rejection of independent claim 10." Applicant notes that this statement clearly contradicts the record, wherein Applicant stated in the response to the previous Office Action that "Applicant traverses each of the rejections." This statement immediately followed an express acknowledgement of the rejection of claim 10 as anticipated by Egermeier, *et al.* Applicant concedes that no argument was presented in that response relative to claim 10. However, that observation goes to the responsiveness of Applicant's argument and not to the ultimate question of whether Applicant traversed the rejection. It is apparent from the argument presented that Applicant erroneously believed that the same limitation argued for claim 1 appeared in claim 10. Applicant also argued that claims 1-15 were allowable over the art of record, which is an implicit traversal of the rejection of claim 10. Accordingly, Applicant has consistently traversed the rejection of claim 10.

## IX. APPENDIX

Copies of the claims at issue, *i.e.*, claims 1-15, are set forth in the Appendix, along claims 16-36, which have been withdrawn from consideration.

## X. CONCLUSION

An anticipating reference, by definition, must disclose every limitation of the rejected claim in the same relationship to one another as set forth in the claim. *In re Bond*, 15 U.S.P.Q.2d (BNA) 1566, 1567 (Fed. Cir. 1990). While the test for obvious is different, it requires that each of the limitations of the claim(s) must be taught or suggested by the prior art. Since the art of record fails to teach:

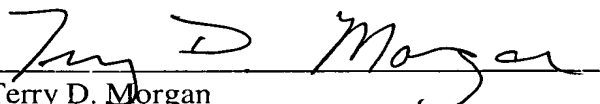
“modifying an operational parameter of the fabrication tool responsive to the result of the spectroscopic analysis,” as recited in independent claim 1 and, hence, dependent claims 2-9; and

“controlling a process flow operation to reduce the amount of the residual material on the wafer responsive to the results of processing the raw spectral data,” as recited in independent claims 10 and, hence, dependent claims 11-15.

Applicant also respectfully submits that the rejections of claims 10-15 are *prima facie* deficient. Thus, claims 1-15 are in condition for allowance.

Please date stamp and return the enclosed postcard to evidence receipt of this document.

Respectfully submitted,

  
Terry D. Morgan  
Reg. No. 31,181

WILLIAMS, MORGAN & AMERSON  
CUSTOMER NUMBER: 23720

Attorney for Applicant

10333 Richmond Dr., Suite 1100  
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(713) 934-7000

Date: January 13, 2004

## **APPENDIX**

1. (Original) A process for use in fabricating an integrated circuit, comprising:
  - performing an operation on a wafer using a fabrication tool;
  - generating desorbed volatiles from the wafer after performing the operation;
  - sampling the desorbed volatiles;
  - generating raw spectral data from the sampled desorbed volatiles, the raw spectral data indicating the content of the desorbed volatiles;
  - performing a spectroscopic analysis of the raw spectral data; and
  - modifying an operational parameter of the fabrication tool responsive to the result of the results of the spectroscopic analysis.
2. (Original) The process of claim 1, wherein performing an operation on a wafer using a fabrication tool includes performing a chemical mechanical polishing operation, a plasma etching operation, or a wafer cleaning operation.
3. (Original) The process of claim 2, wherein modifying the operational parameter of the fabrication tool includes increasing a rinse time or increasing a polishing time of the chemical mechanical polishing operation.
4. (Original) The process of claim 1, wherein modifying the operational parameter of the fabrication tool includes increasing a rinse time of a chemical mechanical polishing operation, increasing a polishing time of a chemical mechanical polishing operation, resetting a scheduled maintenance time.
5. (Original) The process of claim 1, wherein generating desorbed volatiles from the wafer after performing the operation includes heating the wafer in a vacuum chamber to generate desorbed volatiles.
6. (Original) The process of claim 5, wherein heating the wafer in a vacuum chamber includes heating the wafer in a lamp degas chamber or a pedestal temperature controlled process chamber.
7. (Original) The process of claim 1, wherein sampling the desorbed volatiles includes sampling the desorbed volatiles with a residual gas analyzer.



1 8. (Original) The process of claim 1, wherein modifying the operational parameter  
2 includes issuing a new APC plan.

1 9. (Original) The process of claim 1, further comprising at least one of:  
2 storing the results of the spectroscopic analysis;  
3 performing a trend analysis on the results of the spectroscopic analysis; and  
4 performing a variability analysis on the results of the spectroscopic analysis.

1 10. (Original) A process for use in fabricating an integrated circuit, comprising:  
2 receiving raw spectral data representative of the content of a plurality of volatiles  
3 desorbed from a wafer;  
4 processing the raw spectral data to determine the presence of a residual material on  
5 the wafer; and  
6 controlling a process flow operation to reduce the amount of the residual material on  
7 the wafer responsive to the results of processing the raw spectral data.

1 11. (Original) The process of claim 10, wherein receiving the raw spectral data includes  
2 receiving the raw spectral data through at least one of a sensor interface and a data handler.

1 12. (Original) The process of claim 10, wherein processing the raw spectral data includes  
2 performing a spectroscopic analysis on the raw spectral data.

1 13. (Original) The process of claim 10, wherein controlling the process flow operation to  
2 reduce the amount of the residual material on the wafer includes modifying an operational  
3 parameter of a fabrication tool.

1 14. (Original) The process of claim 13, wherein modifying the operational parameter  
2 includes issuing a new APC plan.

1 15. (Original) The process of claim 10, further comprising at least one of:  
2 storing the results of the spectroscopic analysis;  
3 performing a trend analysis on the results of the spectroscopic analysis; and  
4 performing a variability analysis on the results of the spectroscopic analysis.

1 16. (Original) A program storage medium encoded with instructions that, when executed  
2 by a computer, perform a method for use in fabricating an integrated circuit, the method  
3 comprising:

4 receiving raw spectral data representative of the content of a plurality of volatiles  
5 desorbed from a wafer;

6 processing the raw spectral data to determine the presence of a residual material on  
7 the wafer; and

8 controlling a process flow operation to reduce the amount of the residual material on  
9 the wafer responsive to the results of processing the raw spectral data.

1 17. (Original) The program storage medium of claim 16, wherein receiving the raw  
2 spectral data in the encoded method includes receiving the raw spectral data through at least  
3 one of a sensor interface and a data handler.

1 18. (Original) The program storage medium of claim 16, wherein processing the raw  
2 spectral data in the encoded method includes performing a spectroscopic analysis on the raw  
3 spectral data.

1 19. (Original) The program storage medium of claim 16, wherein controlling the process  
2 flow operation to reduce the amount of the residual material on the wafer in the encoded  
3 method includes modifying an operational parameter of a fabrication tool.

1 20. (Original) The program storage medium of claim 19, wherein modifying the  
2 operational parameter in the encoded method includes issuing a new APC plan.

1 21. (Original) The program storage medium of claim 16, wherein the encoded method  
2 further comprising at least one of:

3 storing the results of the spectroscopic analysis;

4 performing a trend analysis on the results of the spectroscopic analysis; and

5 performing a variability analysis on the results of the spectroscopic analysis.

1 22. (Original) A computer programmed to perform a method for use in fabricating an  
2 integrated circuit, the method comprising:

3 receiving raw spectral data representative of the content of a plurality of volatiles  
4 desorbed from a wafer;

5 processing the raw spectral data to determine the presence of a residual material on  
6 the wafer; and  
7 controlling a process flow operation to reduce the amount of the residual material on  
8 the wafer responsive to the results of processing the raw spectral data.

1 23. (Original) The programmed computer of claim 22, wherein receiving the raw spectral  
2 data in the programmed method includes receiving the raw spectral data through at least one  
3 of a sensor interface and a data handler.

1 24. (Original) The programmed computer of claim 22, wherein processing the raw  
2 spectral data in the programmed method includes performing a spectroscopic analysis on the  
3 raw spectral data.

1 25. (Original) The programmed computer of claim 22, wherein controlling the process  
2 flow operation to reduce the amount of the residual material on the wafer in the programmed  
3 method includes modifying an operational parameter of a fabrication tool.

1 26. (Original) The programmed computer of claim 25, wherein modifying the operational  
2 parameter in the programmed method includes issuing a new APC plan.

1 27. (Original) The programmed computer of claim 22, wherein the programmed method  
2 further comprising at least one of:

3 storing the results of the spectroscopic analysis;

4 performing a trend analysis on the results of the spectroscopic analysis; and

5 performing a variability analysis on the results of the spectroscopic analysis.

1 28. (Original) An apparatus for processing wafers to fabricate integrated circuits thereon,  
2 comprising:

3 a fabrication tool capable of performing an operation defined by a plurality of  
4 operational parameters;

5 a vacuum chamber for processing a wafer processed by the fabrication tool;

6 a residual gas analyzer positioned in the vacuum chamber to sample volatiles  
7 desorbed by the wafer when the wafer is heated in a vacuum and output data  
8 indicating the content of the desorbed volatiles; and

9 a computer system capable of performing a spectroscopic analysis on the data output  
10 by the residual gas analyzer and adjusting at least one operational parameter of  
11 the fabrication tool responsive to the results of the spectroscopic analysis.

1 29. (Original) The apparatus of claim 28, wherein the fabrication tool includes a chemical  
2 mechanical polishing tool, a plasma etching tool, or a wafer cleaning tool.

1 30. (Original) The apparatus of claim 28, wherein the vacuum chamber comprises a  
2 portion of a vacuum cluster tool.

1 31. (Original) The apparatus of claim 28, wherein the vacuum chamber comprises a lamp  
2 degas chamber or a pedestal temperature controlled process chamber.

1 32. (Original) The apparatus of claim 28, wherein the computer system comprising a  
2 plurality of networked computing devices.

1 33. (Original) The apparatus of claim 28, wherein the computer system comprises an  
2 Advanced Process Control System.

1 34. (Original) The apparatus of claim 28, wherein at least a part of the computer system  
2 resides on at least one of the fabrication tool and the vacuum chamber.

1 35. (Original) The apparatus of claim 28, further comprising a second fabrication tool of  
2 which the vacuum chamber comprising a portion.

1 36. (Original) The apparatus of claim 28, wherein the vacuum chamber comprises a  
2 portion of the fabrication tool.



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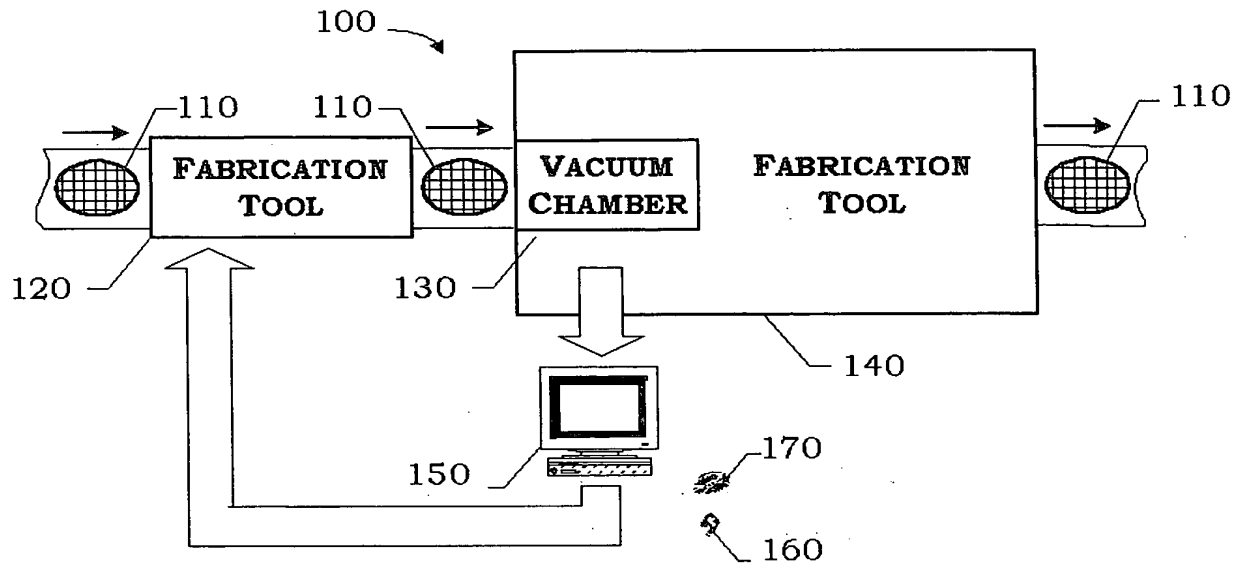
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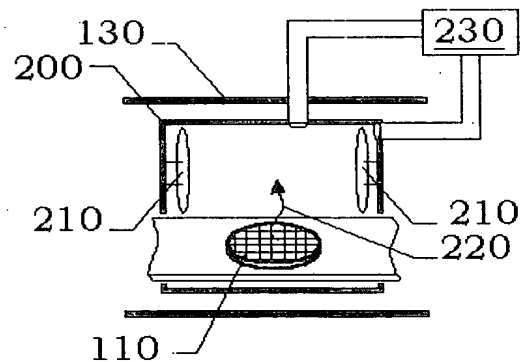
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**FIG. 1**

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**FIG. 2**

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Thus, volatiles are desorbed (at 320, Figure 3), as indicated by the arrow 220, from the wafer 110. The desorbed volatiles are sampled (at 330, Figure 3) and raw spectral data indicating the content of the desorbed volatiles is generated (at 340, Figure 3). The raw spectral data is subjected (at 350, Figure 3) to a spectroscopic analysis. An operational parameter of the fabrication tool is then modified (at 360, Figure 3) responsive to the results of the spectroscopic analysis.

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This response is faulty in a number of respects, such as the fact that the Office's disagreement with Applicant's construction does not moot Applicant's argument, but merely contests it. However, more seriously, there is no reasoning as to why rejecting a wafer is equivalent to modifying an operational parameter. Applicant respects that the statement is without merit since modifying an operation parameter will affect subsequent processing of other wafers whereas rejecting a wafer will no absolutely no affect on subsequent processing of other wafers.

**B. Claims 10-15 are Patentable Over Egermeier, *et al.***

The rejections of claims 10-15 all rely on Egermeier, *et al.* for teaching "controlling a process flow operation to reduce the amount of the residual material on the wafer responsive to the results of processing the raw spectral data." Applicant notes that the "final" Office Action failed to point out where Egermeier, *et al.* allegedly teaches this limitation. Thus, the Office has failed to discharge its *prima facie* burden of demonstrating anticipation of claims 10-15. However, even were this not so, Applicant respectfully submits that Egermeier, *et al.* teaches no such "controlling," but is instead directed to rejecting defective wafers, as is established above.

Applicant also notes that the "final" Office Action states that "...Applicants [sic] do not traverse the rejection of independent claim 10." Applicant notes that this statement clearly contradicts the record, wherein Applicant stated in the response to the previous Office Action that "Applicant traverses each of the rejections." This statement immediately followed an express acknowledgement of the rejection of claim 10 as anticipated by Egermeier, *et al.* Applicant concedes that no argument was presented in that response relative to claim 10. However, that observation goes to the responsiveness of Applicant's argument and not to the ultimate question of whether Applicant traversed the rejection. It is apparent from the argument presented that Applicant erroneously believed that the same limitation argued for claim 1 appeared in claim 10. Applicant also argued that claims 1-15 were allowable over the art of record, which is an implicit traversal of the rejection of claim 10. Accordingly, Applicant has consistently traversed the rejection of claim 10.

## IX. APPENDIX

Copies of the claims at issue, *i.e.*, claims 1-15, are set forth in the Appendix, along claims 16-36, which have been withdrawn from consideration.

## X. CONCLUSION

An anticipating reference, by definition, must disclose every limitation of the rejected claim in the same relationship to one another as set forth in the claim. *In re Bond*, 15 U.S.P.Q.2d (BNA) 1566, 1567 (Fed. Cir. 1990). While the test for obvious is different, it requires that each of the limitations of the claim(s) must be taught or suggested by the prior art. Since the art of record fails to teach:

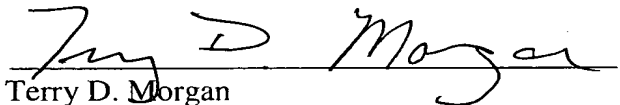
“modifying an operational parameter of the fabrication tool responsive to the result of the spectroscopic analysis,” as recited in independent claim 1 and, hence, dependent claims 2-9; and

“controlling a process flow operation to reduce the amount of the residual material on the wafer responsive to the results of processing the raw spectral data,” as recited in independent claims 10 and, hence, dependent claims 11-15.

Applicant also respectfully submits that the rejections of claims 10-15 are *prima facie* deficient. Thus, claims 1-15 are in condition for allowance.

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Respectfully submitted,



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## APPENDIX

- 1        1.        (Original) A process for use in fabricating an integrated circuit, comprising:  
2                performing an operation on a wafer using a fabrication tool;  
3                generating desorbed volatiles from the wafer after performing the operation;  
4                sampling the desorbed volatiles;  
5                generating raw spectral data from the sampled desorbed volatiles, the raw spectral  
6                data indicating the content of the desorbed volatiles;  
7                performing a spectroscopic analysis of the raw spectral data; and  
8                modifying an operational parameter of the fabrication tool responsive to the result of  
9                the results of the spectroscopic analysis.
- 1        2.        (Original) The process of claim 1, wherein performing an operation on a wafer using  
2                a fabrication tool includes performing a chemical mechanical polishing operation, a plasma  
3                etching operation, or a wafer cleaning operation.
- 1        3.        (Original) The process of claim 2, wherein modifying the operational parameter of the  
2                fabrication tool includes increasing a rinse time or increasing a polishing time of the chemical  
3                mechanical polishing operation.
- 1        4.        (Original) The process of claim 1, wherein modifying the operational parameter of the  
2                fabrication tool includes increasing a rinse time of a chemical mechanical polishing  
3                operation, increasing a polishing time of a chemical mechanical polishing operation, resetting  
4                a scheduled maintenance time.
- 1        5.        (Original) The process of claim 1, wherein generating desorbed volatiles from the  
2                wafer after performing the operation includes heating the wafer in a vacuum chamber to  
3                generate desorbed volatiles.
- 1        6.        (Original) The process of claim 5, wherein heating the wafer in a vacuum chamber  
2                includes heating the wafer in a lamp degas chamber or a pedestal temperature controlled  
3                process chamber.
- 1        7.        (Original) The process of claim 1, wherein sampling the desorbed volatiles includes  
2                sampling the desorbed volatiles with a residual gas analyzer.

1 8. (Original) The process of claim 1, wherein modifying the operational parameter  
2 includes issuing a new APC plan.

1 9. (Original) The process of claim 1, further comprising at least one of:  
2 storing the results of the spectroscopic analysis;  
3 performing a trend analysis on the results of the spectroscopic analysis; and  
4 performing a variability analysis on the results of the spectroscopic analysis.

1 10. (Original) A process for use in fabricating an integrated circuit, comprising:  
2 receiving raw spectral data representative of the content of a plurality of volatiles  
3 desorbed from a wafer;  
4 processing the raw spectral data to determine the presence of a residual material on  
5 the wafer; and  
6 controlling a process flow operation to reduce the amount of the residual material on  
7 the wafer responsive to the results of processing the raw spectral data.

1 11. (Original) The process of claim 10, wherein receiving the raw spectral data includes  
2 receiving the raw spectral data through at least one of a sensor interface and a data handler.

1 12. (Original) The process of claim 10, wherein processing the raw spectral data includes  
2 performing a spectroscopic analysis on the raw spectral data.

1 13. (Original) The process of claim 10, wherein controlling the process flow operation to  
2 reduce the amount of the residual material on the wafer includes modifying an operational  
3 parameter of a fabrication tool.

1 14. (Original) The process of claim 13, wherein modifying the operational parameter  
2 includes issuing a new APC plan.

1 15. (Original) The process of claim 10, further comprising at least one of:  
2 storing the results of the spectroscopic analysis;  
3 performing a trend analysis on the results of the spectroscopic analysis; and  
4 performing a variability analysis on the results of the spectroscopic analysis.

1 16. (Original) A program storage medium encoded with instructions that, when executed  
2 by a computer, perform a method for use in fabricating an integrated circuit, the method  
3 comprising:

4 receiving raw spectral data representative of the content of a plurality of volatiles  
5 desorbed from a wafer;

6 processing the raw spectral data to determine the presence of a residual material on  
7 the wafer; and

8 controlling a process flow operation to reduce the amount of the residual material on  
9 the wafer responsive to the results of processing the raw spectral data.

1 17. (Original) The program storage medium of claim 16, wherein receiving the raw  
2 spectral data in the encoded method includes receiving the raw spectral data through at least  
3 one of a sensor interface and a data handler.

1 18. (Original) The program storage medium of claim 16, wherein processing the raw  
2 spectral data in the encoded method includes performing a spectroscopic analysis on the raw  
3 spectral data.

1 19. (Original) The program storage medium of claim 16, wherein controlling the process  
2 flow operation to reduce the amount of the residual material on the wafer in the encoded  
3 method includes modifying an operational parameter of a fabrication tool.

1 20. (Original) The program storage medium of claim 19, wherein modifying the  
2 operational parameter in the encoded method includes issuing a new APC plan.

1 21. (Original) The program storage medium of claim 16, wherein the encoded method  
2 further comprising at least one of:

3 storing the results of the spectroscopic analysis;

4 performing a trend analysis on the results of the spectroscopic analysis; and

5 performing a variability analysis on the results of the spectroscopic analysis.

1 22. (Original) A computer programmed to perform a method for use in fabricating an  
2 integrated circuit, the method comprising:

3 receiving raw spectral data representative of the content of a plurality of volatiles  
4 desorbed from a wafer;

5 processing the raw spectral data to determine the presence of a residual material on  
6 the wafer; and  
7 controlling a process flow operation to reduce the amount of the residual material on  
8 the wafer responsive to the results of processing the raw spectral data.

1 23. (Original) The programmed computer of claim 22, wherein receiving the raw spectral  
2 data in the programmed method includes receiving the raw spectral data through at least one  
3 of a sensor interface and a data handler.

1 24. (Original) The programmed computer of claim 22, wherein processing the raw  
2 spectral data in the programmed method includes performing a spectroscopic analysis on the  
3 raw spectral data.

1 25. (Original) The programmed computer of claim 22, wherein controlling the process  
2 flow operation to reduce the amount of the residual material on the wafer in the programmed  
3 method includes modifying an operational parameter of a fabrication tool.

1 26. (Original) The programmed computer of claim 25, wherein modifying the operational  
2 parameter in the programmed method includes issuing a new APC plan.

1 27. (Original) The programmed computer of claim 22, wherein the programmed method  
2 further comprising at least one of:

3 storing the results of the spectroscopic analysis;

4 performing a trend analysis on the results of the spectroscopic analysis; and

5 performing a variability analysis on the results of the spectroscopic analysis.

1 28. (Original) An apparatus for processing wafers to fabricate integrated circuits thereon,  
2 comprising:

3 a fabrication tool capable of performing an operation defined by a plurality of  
4 operational parameters;

5 a vacuum chamber for processing a wafer processed by the fabrication tool;

6 a residual gas analyzer positioned in the vacuum chamber to sample volatiles  
7 desorbed by the wafer when the wafer is heated in a vacuum and output data  
8 indicating the content of the desorbed volatiles; and

9 a computer system capable of performing a spectroscopic analysis on the data output  
10 by the residual gas analyzer and adjusting at least one operational parameter of  
11 the fabrication tool responsive to the results of the spectroscopic analysis.

1 29. (Original) The apparatus of claim 28, wherein the fabrication tool includes a chemical  
2 mechanical polishing tool, a plasma etching tool, or a wafer cleaning tool.

1 30. (Original) The apparatus of claim 28, wherein the vacuum chamber comprises a  
2 portion of a vacuum cluster tool.

1 31. (Original) The apparatus of claim 28, wherein the vacuum chamber comprises a lamp  
2 degas chamber or a pedestal temperature controlled process chamber.

1 32. (Original) The apparatus of claim 28, wherein the computer system comprising a  
2 plurality of networked computing devices.

1 33. (Original) The apparatus of claim 28, wherein the computer system comprises an  
2 Advanced Process Control System.

1 34. (Original) The apparatus of claim 28, wherein at least a part of the computer system  
2 resides on at least one of the fabrication tool and the vacuum chamber.

1 35. (Original) The apparatus of claim 28, further comprising a second fabrication tool of  
2 which the vacuum chamber comprising a portion.

1 36. (Original) The apparatus of claim 28, wherein the vacuum chamber comprises a  
2 portion of the fabrication tool.